Changes in airway volume in adult patients following orthodontic treatment with premolar extractions versus non-extraction

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OBJECTIVES: Recent concerns about the prevalence of obstructive sleep apnea (OSA) and its negative sequelae have led to investigations of how manipulation of the dentofacial complex may affect airway problems. CBCT can be used to measure airway dimensions of patients. Extraction of premolars is indicated as part of orthodontic treatment for patients who have severe crowding or protrusion of incisors. Some have suggested that the reduction in arch circumference after premolar extraction would lead to decreased airway volume, which may predispose a patient for sleep disordered breathing (SDB). The purpose of this study was to determine whether there is a significant change in airway dimensions for adult patients who were treated with premolar extractions in conjunction with orthodontic treatment compared to those who received treatment without extractions.

METHODS: Pre- (T1) and Post-treatment (T2) CBCTs were collected for adult patients who received comprehensive orthodontic treatment in the Orthodontics clinic. There were 36 adult patients in both the experimental (extraction) group and the control group. The airway was divided into three regions: nasopharynx, upper oropharynx, and lower oropharynx. Volumetric measurements and minimal cross sectional areas (MCAs) were calculated for each of the 3 regions using Invivo 6 software. Additionally, the A/P length, transverse width, and MCA were measured at each of the 3 regions. In total, 15 airway measurements per patient were made by two judges. Statistical analysis was performed using t-tests to determine differences in the means between the two groups. Significance was reported at $p < 0.10$. Inter-judge reliability was also assessed using the Cronbach alpha method.

RESULTS: At baseline (T1), 6 out of 15 airway dimension variables were significantly different between the extraction and non-extraction groups, with the extraction group having larger values in each instance. At T2, six variables were again statistically different between the two groups, with the extraction group having larger values. When analyzing the differences that occurred during treatment (T2-T1), the only statistically significant measurement was the upper airway MCA, which decreased in the extraction group and increased in the non-extraction group. However, inter-judge reliability was poorest for this measurement, indicating difficulty in standardizing the procedure for measuring this region.

CONCLUSIONS: For every airway measurement examined except the upper airway MCA, there was no significant difference after orthodontic treatment in both the extraction and non-extraction groups. Inter-judge reliability of the measurement of upper MCA was poor, so this result should be interpreted with caution.